National Aeronautics and
Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

# MODIS/AIRS & HIRS/AIRS Radiometric Comparisons (Brightness Temperatures at 11 microns)

**Steve Broberg, Dave Gregorich and George Aumann**

**AIRS Science Team Meeting**

**10 March 2006**

National Aeronautics and
Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

# Introduction

- Motivation
  - Ongoing AIRS instrument validation, with an interest in examining differences for cold scenes.
  - Climate studies require analysis across/between multiple instruments/platforms, needing to contend with instrument spectral bandpass differences, spatial footprint variations, and orbital variations.
- Data set
  - MODIS band 31, HIRS channel 8 (both 11 um window channels) and selected 11 um region AIRS channels provide a reasonable data set for developing comparison methods.

National Aeronautics and
Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

# Introduction (cont.)

- The calibration of AIRS and MODIS has been established at better than the 0.1 K level for MODIS band 31, for one day means for two test days on 20020906 and 20040218 (Tobin)
- We used tropical ocean daytime granule 20020906.176 and night time antarctic granule 20020906.72 to verify this.
- Can this result be repeated with more recent data?
- What happens when we look at the radiometric validation over Antarctica?

National Aeronautics and
Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

# Method

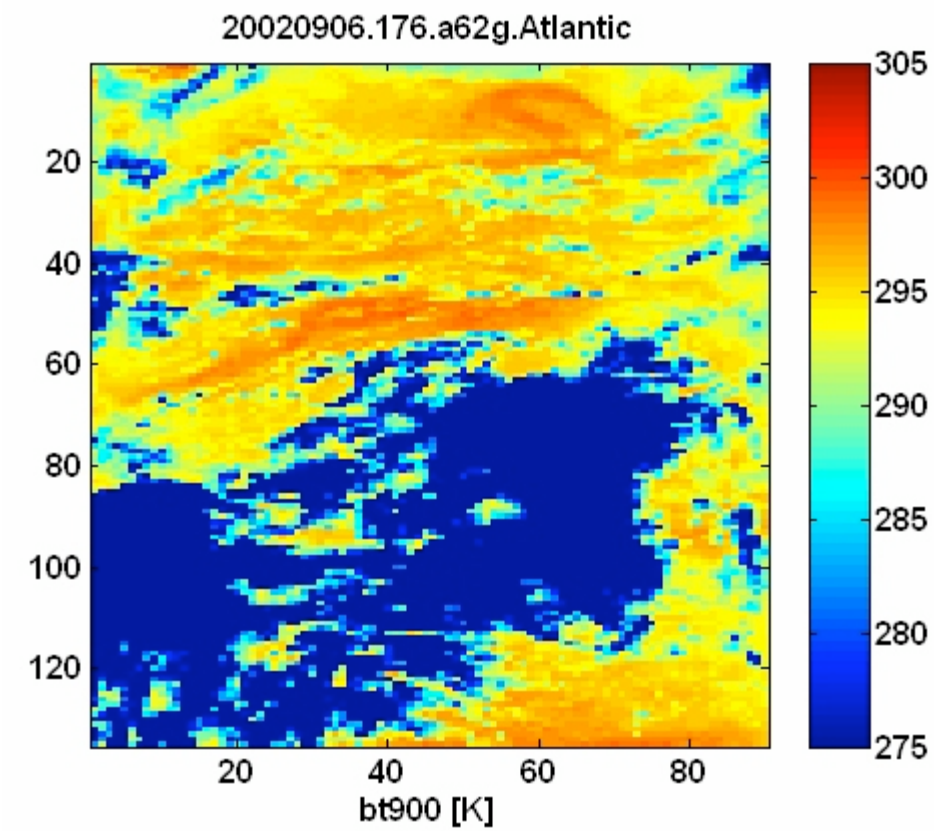
- MODIS - AIRS comparisons
  - Average MODIS band 31 (11 um) data to 5 km x 5 km
  - Approximate broadband 11 um band brightness temperatures with a linear combination of AIRS channels with frequencies 900, 912.7, 881, and 891.
  - Matchup MODIS 5 km x 5 km pixels with AIRS, using 0.075 surface degrees (~8 km) distance criterion. Results in ~9 matches per AIRS footprint.
- HIRS - AIRS comparisons
  - Use same prescription for 11 um broadband radiance (assumed to be the same as MODIS band 31).
  - Matchup AIRS footprints with HIRS footprints (20 km on 40x26 km centers), using 0.07 surface degree criterion. Results in 1 AIRS/HIRS match.

National Aeronautics and
Space Administration

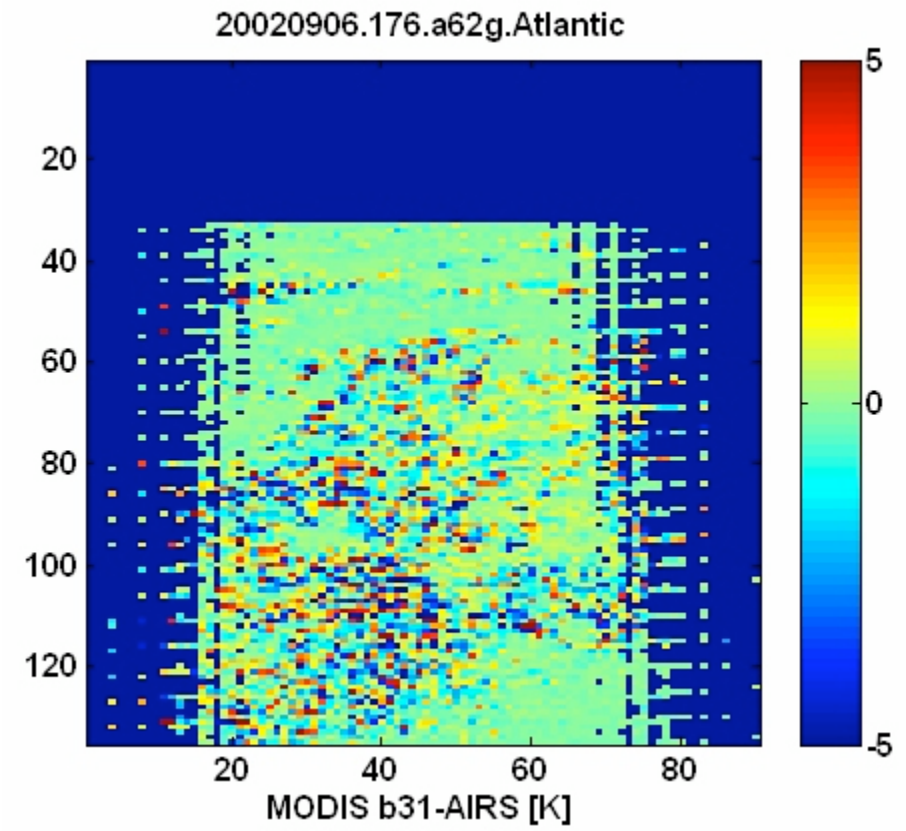
**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

# Differences in areas of high gradient are due to matchup uncertainties.

**AIRS Brightness Temp., 11.1 um**




**MODIS band 31 – AIRS matchup differences.**

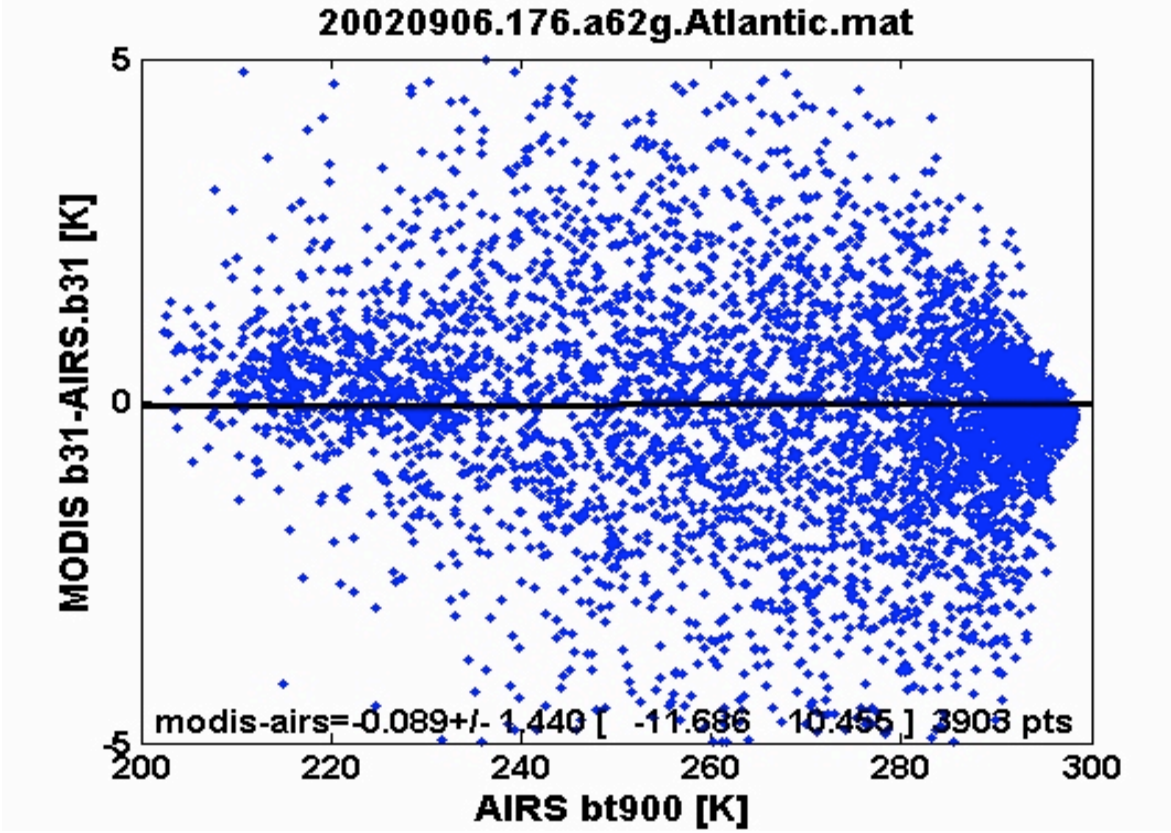



Broberg, Gregorich, Aumann JPL

National Aeronautics and Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

# The comparison for 20020906 tropical ocean granule 176 looks very good down to the 200 K level




There is a very small bias and there is a small slope.

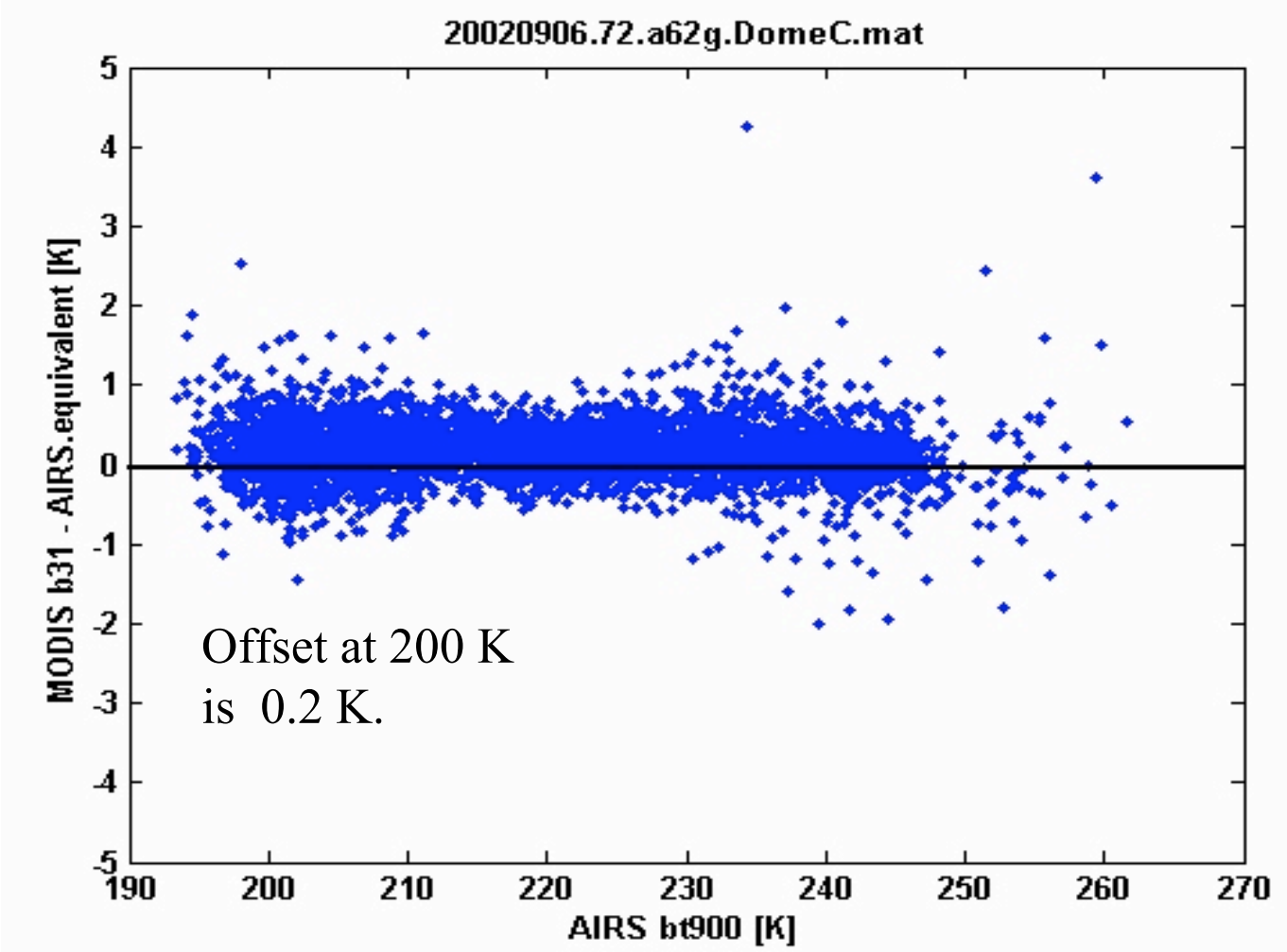
MODIS b31 is 0.3 K warmer than AIRS at 200 K, 0.1K colder at 300 K.

Broberg, Gregorich, Aumann JPL

National Aeronautics and
Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

# The 20020906 granule 72 Dome C overpass comparison of MODIS and AIRS shows excellent agreement

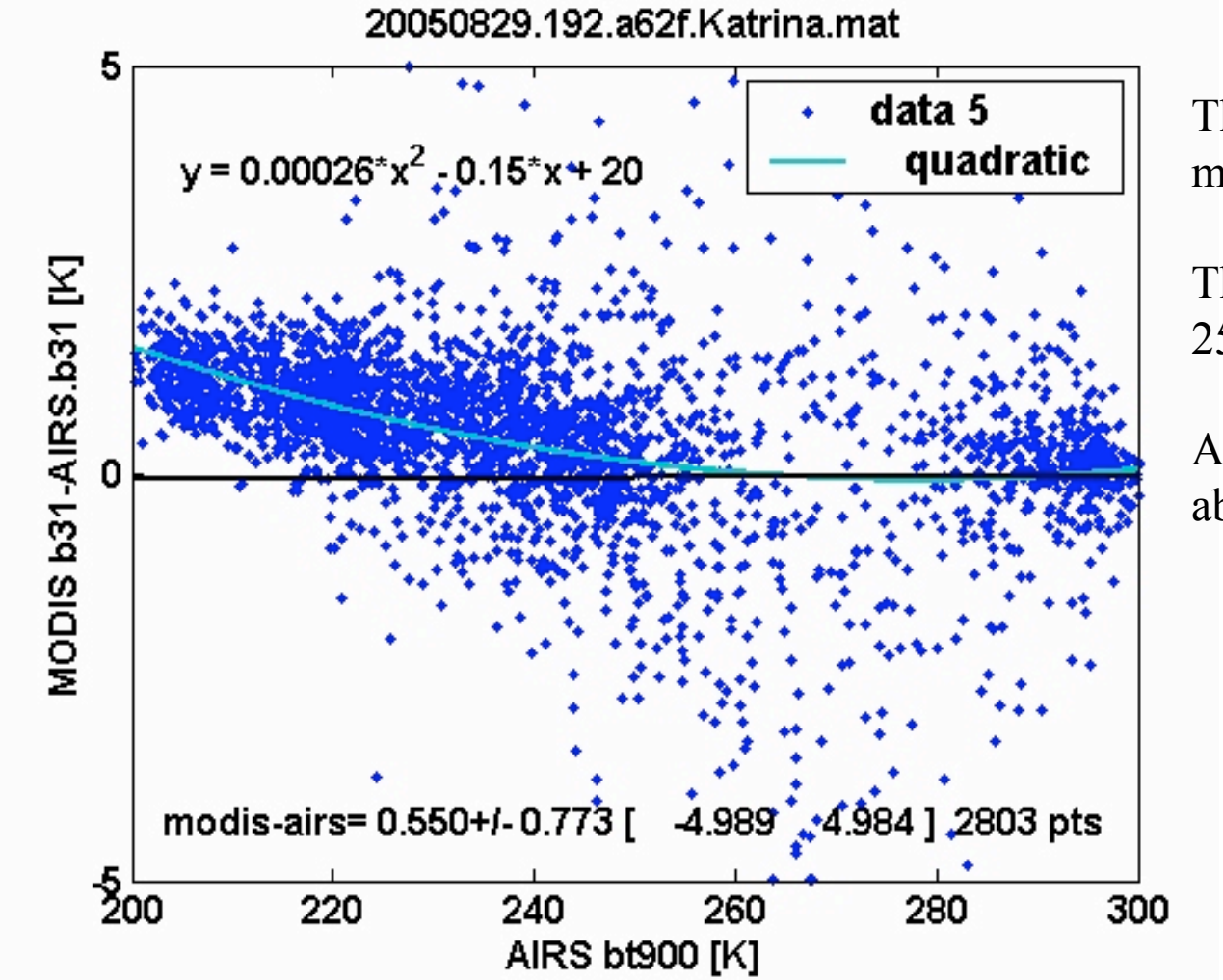



Broberg, Gregorich, Aumann

National Aeronautics and Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

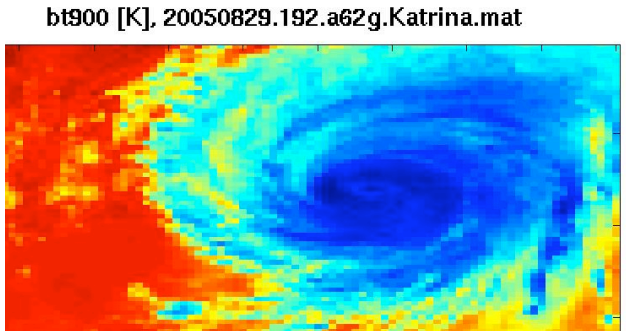
# 20050829, granule 192 is the New Orleans overpass with Katrina at 1:30 pm




The 20050829 data look much more complicated.

There is little offset between 250 and 300K.

At 200 K, MODIS band 31 is about 1.1 K warmer than AIRS.

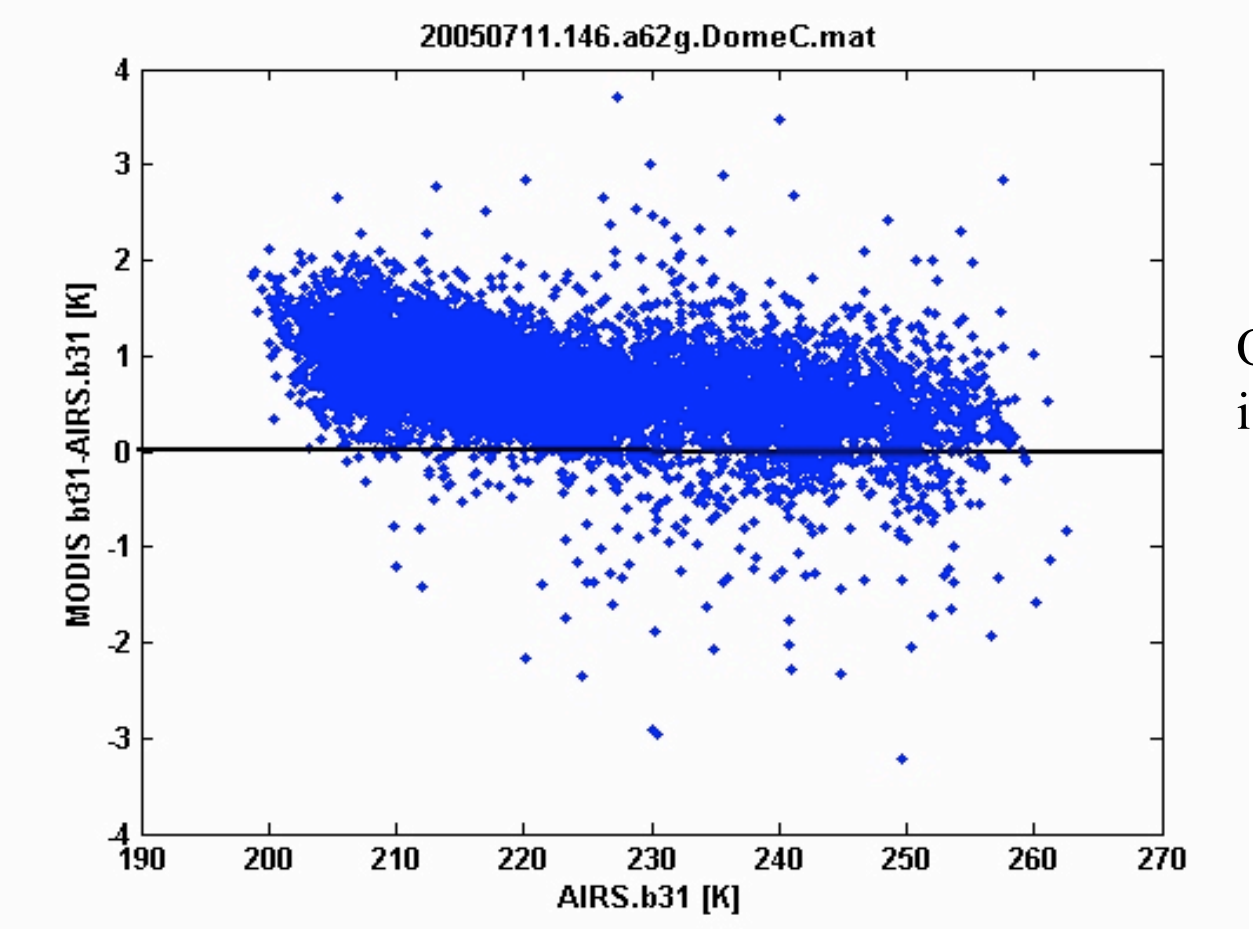



Broberg, Gregorich, Aumann JPL

National Aeronautics and
Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

# Recent (20050711) Dome C data also show a cold shift

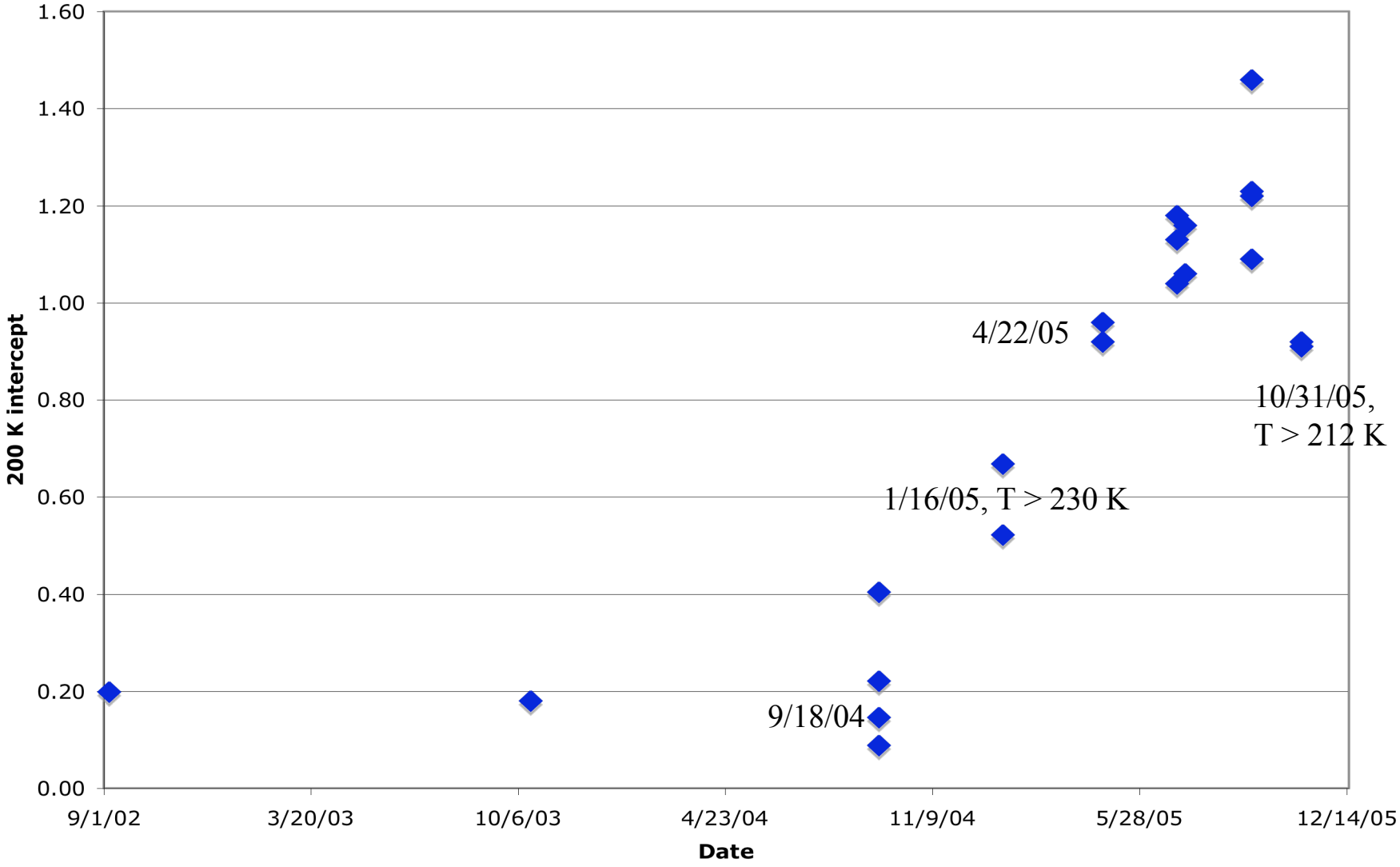



Offset at 200 K is also 1.1 K.

National Aeronautics and Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

# Trend of 200 K offset over Antarctica



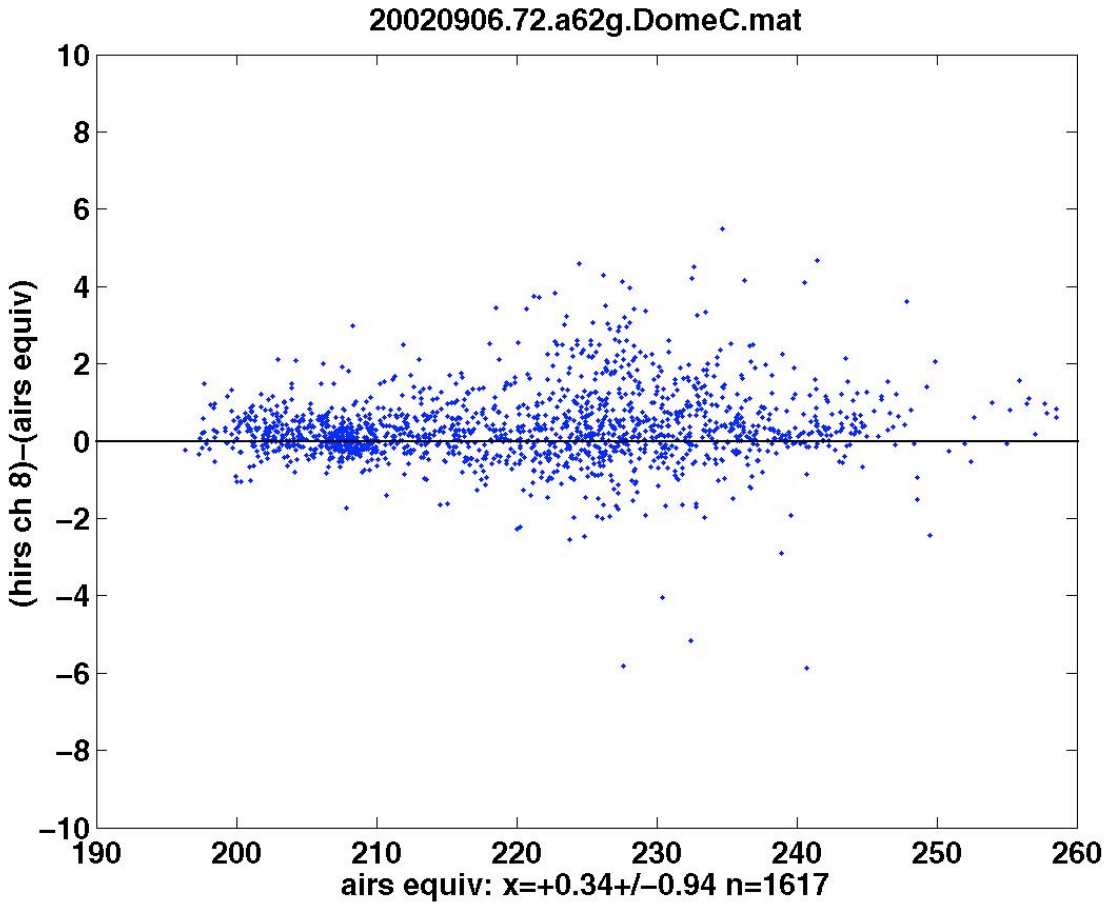

Broberg, Gregorich, Aumann

JPL

National Aeronautics and
Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

# HIRS channel 8 - AIRS equivalent, 20020906

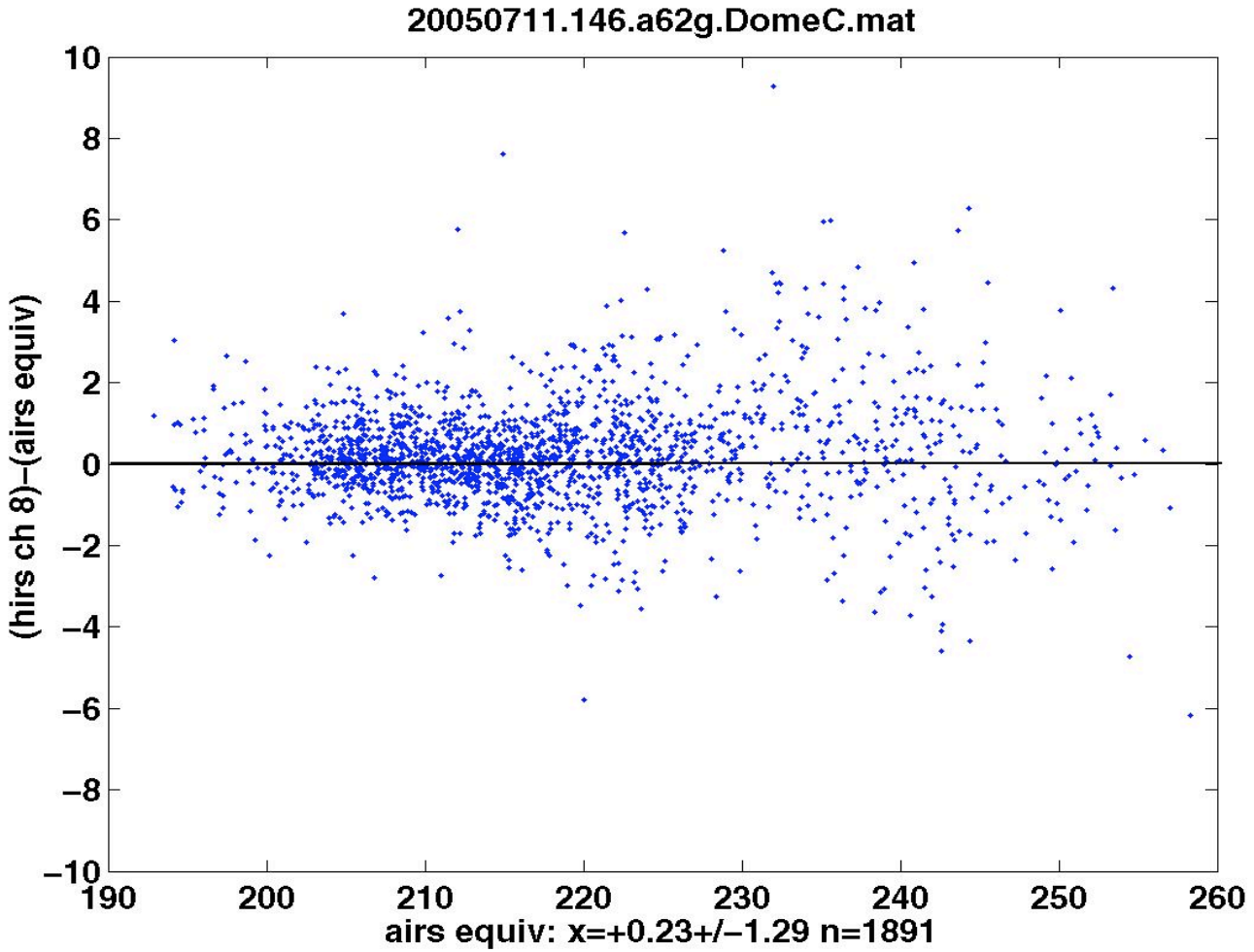



Broberg, Gregorich, Aumann JPL

National Aeronautics and
Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

# HIRS channel 8 - AIRS equivalent, 20050711




Broberg, Gregorich, Aumann

National Aeronautics and
Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

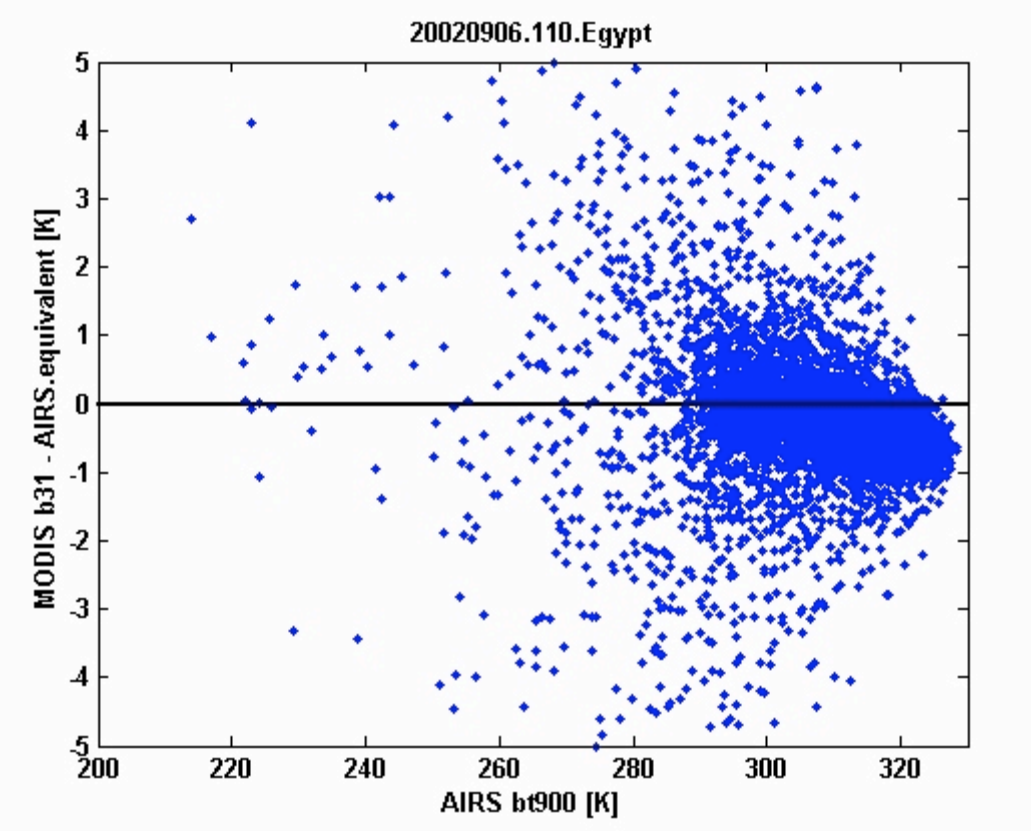
# Conclusion

- This is a work in progress, however, first indications are
  - MODIS - AIRS brightness temperature differences indicate a change has occurred.
  - HIRS - AIRS has remained steady
- Will expand data set to include deep convective cloud tops for warmer antarctic months, as well as warmer land scenes to better define trends.
- A more complete analysis will be presented in the August 2006 SPIE meeting in San Diego.

National Aeronautics and Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

# 20020906 Egypt granule 110 comparison shows a warm bias




In granule 176 MODIS is 0.1 K colder than AIRS at 300 K
In granule 110 MODIS is 0.8 K colder than AIRS at 325 K